Influence of dynamic and semi-rigid implants in the mono-segmentally fused lumbar spine - a biomechanical cadaver study-

INTRODUCTION:
The degeneration of the adjacent segment in lumbar spine with spondylodesis is well known, though the exact incidence and the mechanism is not clear. Several implants with semi rigid or dynamic behavior are available to reduce the biomechanical forces and prevent an adjacent segment disease (ASD). Randomized controlled trials are not published. We investigated the biomechanical influence of dynamic and semi rigid implants on the adjacent segment in cadaver lumbar spine with monosegmental fusion (MF).

METHODS:
14 fresh cadaver lumbar spines were prepared; capsules and ligaments were kept intact. Pure moments of ±7.5 Nm were applied without preload in lateral bending and flexion/extension [1]. The intradiscal pressure (IDP) and the range of motion (ROM) were measured in the segments L2/3 and L3/4 in following situations: in the native spine, monosegmental fusion L4/5 (MF), MF with dynamic rod to L3/4 (Dynabolt™), MF with interspinous implant L3/4 (Coflex™), and semi rigid fusion with Peek Rod (CD Horizon Legacy™) L3-L5.

RESULTS:
All implants reduced under flexion the IDP of segment L2/L3, whereas the IDP in the segment L3/4 increased using interspinous implants compared to the other groups. All semi rigid or dynamic implants reduced the IDP in extension in both segments. Compared to the native spine the MF had under extension no influence on the IDP of the adjacent disc (Fig.1).

A similar effect is seen in L2. The ROM in lateral bending is reduced in L2 and L3 by all implants. Specimens with interspinous support had similar measurements compared to the MF.

DISCUSSION:
The MF reduced the ROM in all directions, whereas the IDP of the adjacent segment remained unaffected. The support of the adjacent segment by semi rigid and dynamic implants decreased the IDP of both segments mainly in extension. This fact is an agreement with other studies [2, 3, 4]. Compared to our data, they observed no significant effect on the adjacent levels [3, 4]. Interestingly, in our study, the IDP of the adjacent segment is unaffected by MF. The biomechanical influence in the view of an ASD could be comprehended, but is not completely clear. The fact of persistent IDP in the adjacent segment suggests that MF has a lower effect on the adjacent segment degeneration as presumed. Biomechanical studies with human cadaver lumbar spines are limited and depend on age and degenerative situation. The effect on supporting implants on adjacent segment disease in lumbar spine surgery has to be investigated in clinical long term studies.

REFERENCES:
2. Wilke HJ, Drumm J, Häussler K et al.. Biomechanical effect of different lumbar interspinous implants on flexibility and intradiscal pressure. Eur Spine J 2008, 17:1049-56